

REMARKS

Please reconsider the application in view of the above amendments and the following remarks. Applicant thanks the Examiner for carefully considering this application as well as for the courtesies extended during the interview on July 29, 2004. At the outset, Applicants respectfully request return of the initialed PTO Form-1449 from the multiple Information Disclosure Statements filed on July 25, 2002, December 11, 2001, March 25, 2003, and January 13, 2004.

Disposition of Claims

Claims 1, 3-9, 27-30, and 38-42 are pending in this application. Claims 1, 4, 28 and 39 are independent. Claims 4 and 28 have been written in independent form by including the limitations of their base claim 1. Claims 1, 39 and 40 have been amended.

Objections

Following the Examiner's request, we are enclosing copies of the following documents: the European Search Report dated December 29, 2003; the document titled "Marks for Alignment and Registration in Projection Electron Lithography in Projection Electron Lithography", Jour. of Vacuum Science & Technology B; Vol. 11, No. 6, Nov/Dec 1993, pages 2175-2178; and U.S. Patents No. 5,648,188 and 6,204,509. Please note that these documents were included in the Information Disclosure Statement filed on January 13, 2004, which was prior to the mailing date of a Final Action, a Notice of Allowance, or an action that otherwise closes prosecution in the application.

Rejection(s) under 35 U.S.C § 112

Claim 40 stands rejected under 35 U.S.C. 112, second paragraph, as being indefinite due to a typographical error. This error has been corrected above. Accordingly, withdrawal of the rejection is requested.

Rejection(s) under 35 U.S.C § 102

Claims 1, 3, 7-9, 27 and 38-42 stand rejected under 35 U.S.C. § 102 as anticipated by U.S. Patent No. 6,204,509 ("Yahiro *et al.*"). To the extent that this rejection may apply to the amended claims, the rejection is respectfully traversed.

The present invention relates to avoiding deviations of a beam of charged particles from a predetermined path while imaging the pattern of a mask onto a substrate using the beam of charged particles.

Claim 1 as amended defines a deflector for moving the beam cross section of a beam of charged particles along a predetermined path extending over a mask. A sensor detects, concurrently with the imaging operation, a number of the charged particles that impinge on mark region(s) provided on the mask. Further, the deflector is responsive to a measuring signal dependent on the number of charged particles detected by the sensor in order to reduce deviations from the path extending over the mask parallel to the direction of the struts.

Yahiro *et al.* does not disclose detecting the mask's distortion concurrently with the imaging of the mask via the beam of charged particles used for imaging the mask. According to all of the Yahiro *et al.* embodiments using beams of charged

particles to detect distortion, the determination of the mask distortion is made prior to the imaging of the mask's pattern. For example, in the fifth embodiment, Yahiro *et al.* states that "[t]he actual respective positions of the alignment marks 53 for all the individual subfields 50 can be determined prior to exposing any of the subfields 50 of the reticle 5. The necessary manipulation of the electron beam is then calculated in advance for each reticle subfield." (Column 12, lines 60-64, emphasis added.) Regarding the embodiments shown in Figures 10 and 11 of Yahiro *et al.*, in which an electron beam is used for detecting the positions of the alignment marks, a reflected electron detector 25c is disposed upstream of the electron beam EB with respect to the mask and detects electrons of the electron beam which are incident on one of the alignment marks 57d. To detect the position of the alignment mark, the electron beam EB is scanned over the alignment mark 57d in two dimensions (x and y directions). (See column 15, lines 10 to 13.) However, scanning only one single alignment mark is not sufficient for determining the distortion of the mask. For this purpose, the positions of multiple alignment marks must be determined by independently scanning each alignment mark in two dimensions. Then, calculations are performed to determine the absolute positions of the marks in coordinate space, from which information for the subsequent exposure of the pattern onto the substrate can be corrected for any distortion. This, of course, requires the correction parameters to be determined prior to exposure of the substrate.

Amended Claim 39 describes a method for exposing a radiation-sensitive layer. The method comprises generating a shaped beam of charged particles in a plane of a mask providing a pattern to be imaged onto a radiation-sensitive layer; scanning the beam of charged particles along a predetermined path; detecting radiation generated by a

number of the charged particles incident on at least one mark region provided on the mask, wherein the detecting of the radiation is performed concurrently with the exposing of the radiation-sensitive layer; and controlling the scanning of the beam of charged particles based on the detected radiation.

Yahiro *et al.* does not disclose detecting radiation generated by a number of the charged particles incident on at least one mark region concurrently with exposing of the radiation sensitive layer. As explained above, Yahiro *et al.* discloses detecting the radiation generated by charged particles incident on at least one mark region prior to exposing the radiation sensitive layer.

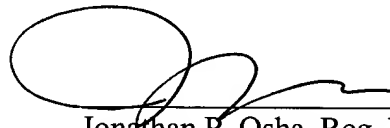
In view of the above, Yahiro *et al.* fails to show or suggest the invention as recited in claims 1 and 39. Thus, claims 1 and 39 are patentable over the cited prior art. Claims 3, 7-9, 27, 38, and 40-42 are dependent, directly or indirectly, from patentable base claims and therefore should be patentable for at least the same reasons. Accordingly, withdrawal of this rejection is respectfully requested.

Claims 4 and 28 have been written in independent form by including the limitations of their base claim 1. Thus, claims 4 and 28 are allowable as indicated by the Examiner in the Office Action dated December 16, 2003. Claims 5 and 6 are dependent from patentable claim 4 and therefore should be patentable for at least the same reasons.

Applicant believes this reply is fully responsive to all outstanding issues and places this application in condition for allowance. If this belief is incorrect, or other issues arise, the Examiner is encouraged to contact the undersigned or his associates at the telephone number listed below. Please apply any charges not covered, or any credits, to Deposit Account 50-0591 (Reference Number 03850/010001).

Respectfully submitted,

Date: 8/1/01



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